INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION

PROCEDURE FOR BENCH TESTING, FIELD EVALUATION, AND APPROVAL LIST REQUIREMENTS FOR SPREAD SPECTRUM RADIO MODEMS
ITM No. 947-05P

1.0 SCOPE.

1.1 This test procedure covers the methods that a spread spectrum radio modem is bench tested, evaluated in the field, and is placed on, maintained on, or removed from an approval list.

1.2 The values stated in either English or acceptable SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore each system shall be used independently of the other, without combining values in any way.

1.3 This ITM may involve hazardous materials, operations, and equipment. This ITM does not purport to address all of the safety problems associated with the ITMs use. The ITM user's responsibility is to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 ASTM Standards.

E 2158 Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer Using Microwave in the 902 to 928 MHz Band

2.2 Federal Specification.

FCC “United State Federal Communications Commission” Title 47, Code for Federal Communication Part 90, Sub Part M.

2.3 Indiana Test Methods or Procedures

806 Approval List Requirements

2.4 NEMA Standards.

TS-2 Traffic Signal Controller Assemblies.

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department’s Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE.

4.1 This ITM is used to evaluate, approve, maintain approval, and remove from the approval listing spread spectrum radio modems which are placed on the Department's List of Approved Traffic Controller Equipment. Each model of the spread spectrum radio modem will be bench tested and field evaluated separately.

4.2 The narrow band spread spectrum modems are used for radio communication interconnections between local and master traffic signal controllers in accordance with the applicable requirements of ASTM E 2158 and FCC Title 47, Code for Federal Communication Part 90, Sub Part M.

5.0 APPARATUS. Radio Field Test Kit**,** Encom model MDL 6500

6.0 SAMPLING. The manufacturer shall furnish, at no cost to the Department; three randomly selected production-run narrow band spread spectrum modems of each model for bench testing and field evaluation.

7.0 PROCEDURE.

7.1 The manufacturer shall fill out the Preliminary Product Material Evaluation Form in attachment A for each model type of radio modem, which the manufacturer is requesting to be added to the listing.

7.2 The manufacturer shall submit with the Evaluation Form the following:

7.2.1 A QCP in accordance with ITM 806, Section 5.1 which also documents the manufacturing specifications for the submitted model of modem.

7.2.2 A certification of environmental testing shall be furnished with each major unit approval request indicating testing has been completed in accordance with NEMA TS2-2. The certification shall specify the model and serial number of the modem tested. A complete log of each test shall be provided to the Department and will be maintained by the Department. If a failure occurs during testing the log shall show which component failed during the test, which phase and time the failure occurred, and what steps were taken to repair the modem. The log shall include the date of testing, name and title of person conducting the tests, a record of conditions throughout the tests, and a temperature and humidity verses time chart. The maximum report interval of any chart shall be 24 h. The chart shall be from a recording machine used to monitor the status of the environmental chamber during testing.

7.2.3 Operation and Maintenance Manual(s), including schematics and components parts listing.

7.2.4 Three randomly selected production run modems for bench testing and field evaluation.

8.0 SUBMITTAL REVIEW. The documentation, including the environmental testing, will be reviewed for usability of the modems with Department approved NEMA TS-2 traffic controllers. The manufacturer's recommended schedule and extent of maintenance will be reviewed for acceptability.

9.0 BENCH TESTING. The modem will be bench tested for compatibility with NEMA TS-2 traffic signal controllers used by the Department. The modem will be bench tested to verify operation as a master, a repeater, a repeater/slave, and a slave modem.

10.0 FIELD EVALUATION

10.1 The field evaluation of the Spread Spectrum modems will consist of installing the modems in an actual traffic signal system for a period of one year. Prior to installation, the radio field test kit may be used, if required, to determine the extent of any radio frequency interference at the selected location. As a minimum the following field evaluation records will be maintained:

10.1.1 A log of any communication failures for the spread spectrum system.

10.1.2 The use of repeaters to achieve communication within the traffic signal system.

10.1.3 The ability to maintain an adequate level of communication for the signal system performance.

10.1.4 The configuration of software for prewritten drivers for all Department approved NEMA TS2 controllers including the ability to automatically determine and to connect at the radios baud, stop and parity settings; the ability for allowing signal level, Received Signal Strength Indication (RSSI), data integrity, message polling, and spectral analysis testing.

10.1.5 The ease of performing diagnostic tests.

10.1.6 The spread spectrum modem's use and availability of any failsafe modes.

11.0 REPORT. A final report will be developed that includes the notations and findings from the electronic bench test and field evaluation results and documentation.

12.0 DEPARTMENT'S LIST OF APPROVED SPREAD SPECTRUM RADIO MODEMS

12.1 Approval of Spread Spectrum Radio Modem. The spread spectrum modem model will be placed on the approved list when the following conditions are met:

12.1.1 The unit passes the NEMA TS-2 environmental tests.

12.1.2 The required documentation is submitted.

12.1.3 No excessive amount of routine or periodic maintenance is required.

12.1.4 No communication failure with any of the different types of NEMA TS-2 traffic controllers used by the Department.

12.1.5 The modem operates as a master, a repeater, a repeater/slave and a slave modem.

12.1.6 No communication failures between the other modems used by the Department.

12.1.7 The configuration software shall:

- Include prewritten drivers for all Department approved NEMA TS2 traffic controllers,
- Be able to automatically determine and connect at the radio's baud, stop and parity settings, and
- Be able to display signal level, RSSI, data integrity, message polling, and results of spectral analysis.

12.1.8 Only minimal maintenance operations were necessary during the field evaluation.

12.2 Maintaining Approval. To maintain approval, the manufacturer shall:

12.2.1 Submit an annual certification of compliance in accordance with Attachment B.

12.2.2 The Manufacture shall notify the Operations Support Division Evaluations Section each time an update or revision of the firmware or software is released, explain the changes, and the benefits of the change. Operations Support Division will determine if the modem will require re-evaluation of the modem with the revision in accordance with section 9.0.

12.2.3 If the manufacturer makes any changes to an approved model to comply with new regulatory or safety requirements, the Department shall be

notified immediately. The manufacturer shall correct all existing equipment purchased by the Department either directly, by contract, or through agreement.

12.2.4 A change to an approved model shall require a submittal of documented changes. At the discretion of the Department, resubmission of the model for testing and evaluation may be required.

12.3 Removal from Approved List. Spread Spectrum Radio Modems will be removed from the approved list for, but not limited to, the following reasons:

12.3.1 Changes in the modem components or production process that fail testing and/or evaluation,

12.3.2 Notification of changes are not provided,

12.3.3 Performance of the spread spectrum modems no longer meets the intended purpose;

12.3.4 Failure to annually submit certifications of compliance;

12.3.5 Changes to the QCP without notification to the Department.

ATTACHMENT A
INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF OPERATIONS SUPPORT
PRELIMINARY INFORMATION FOR PRODUCT MATERIAL EVALUATION

Trade Name _____ Date _____

Manufacturer _____ Patented? Yes _____ No _____ Applied for _____

Address _____
Street No (P. O. Box) City State Zip Code

Representative _____ Phone No ( )_____

Address _____
Street No (P. O. Box) City State Zip Code

Product Information _____

_____

Materials Composition _____

_____

_____

** Is this product considered HAZARDOUS MATERIAL when disposing of non-used or surplus materials? Yes _____ No _____

** What is the shelf life of this material? Years _____Months _____N/A_____

Recommended Use-Primary _____

_____

_____

Recommended Use-Alternate _____

_____

_____

ATTACHMENT A

Advantages and/or Benefits _____

_____

_____

** Materials specifications by manufacturer, installation/operation manual, maintenance manual, literature, test results, guarantee, hazardous material data sheets, plan, picture or sketch must be submitted with this form. In the case of electronic devices the schematic diagram, parts list, and parts layout diagram must be submitted for each printed circuit board within the device.

Meets following specifications:

AASHTO _____ _____

ASTM _____ _____

OTHER _____

Use by highway authorities or similar agencies in other states.

Agency	Years Used	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____

** Has product ever been evaluated by and rejected for use by a governmental agency?

Yes _____ No _____ If yes, by what agency and for what reason?

_____

_____

Will demonstration be provided? Yes _____ No _____

Availability: Seasonal _____ Non-seasonal _____ Delivery at site _____

After receipt of order, are quantities limited? Yes _____ No _____

ATTACHMENT A

** Will FREE SAMPLES be furnished? Yes _____ No _____
If yes, Quantity Furnished _____

** If the sample is salvageable, do you desire to have it returned Yes _____ No _____

(Desired return of salvageable samples will be at the supplier's expense.)
(The manufacturer agrees upon the return of salvageable samples, such samples may be damaged or non-operable. Normal care will be taken that the samples, when returned, are in operable condition; INDOT, however, does not guarantee that the returned samples are operable.)

Will laboratory analysis be furnished? Yes _____ No _____

** Approximate cost _____ Royalty Cost _____

When was the product introduced to the market? _____

This product is an alternate for what product? _____

_____

_____

Will warranty be provided? Yes _____ No _____ If yes, for how long? _____

Background of company, including principal products _____

_____

_____

_____

What offices of the Indiana Department of Transportation have been contacted?

_____

Additional Information _____

_____

_____

_____

(Attach additional sheets as necessary)

ATTACHMENT A

Person furnishing information _____
Name Title

Address _____
Street No (P. O. Box) City State Zip Code

Items marked ** MUST BE RESPONDED TO or further consideration may not be given for this product.

Please mail this form to:

Highway Support Manager
100 N. Senate Ave., Room N925
Indianapolis, IN 46204-2249

If INDOT elects to evaluate your product/material - traffic signal equipment will be shipped to:

Electronic Technician Supervisor
Indiana Department of Transportation
6400 E. 30th Street
Indianapolis, IN 46219-8222

While all other materials to be evaluated will be shipped to:

Traffic Studies Engineer
Indiana Department of Transportation
6400 E. 30th Street
Indianapolis, IN 46219-8222

ATTACHMENT B

Annual Certification Letter for Spread Spectrum Radio Modems

Manufacturer's Name

Manufacturer's Address

I hereby certify that the following Spread Spectrum Modem types have been manufactured with the same manufacturing process and to the same material specifications as the material that was furnished for the evaluation sample and was subsequently placed on the Indiana Department of Transportation's Approved list of Spread Spectrum Modems.

Product Name	Model Number	Type (if applicable)

Name and Title Representing Date